

STRUCTURE	Silicon Monolithic Integrated Circuit
PRODUCT SERIES	Single-Phase Full-Wave Motor Driver for Fan Motor
TYPE	B D 6 9 7 1 F V
FEATURES	Speed controllable by DC/PWM input Current limit circuit PWM soft switching drive

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Limit	Unit
Supply voltage	V _{cc}	20	V
Power dissipation	P _d	874.7 *	mW
Operating temperature	T _{opr}	-40 to +100	°C
Storage temperature	T _{stg}	-55 to +150	°C
Output current	I _{omax}	1.0 * *	A
FG output current	I _{FG}	10	mA
FG output voltage	V _{FG}	20	V
REF current ability	I _{REF}	5	mA
HB current ability	I _{HB}	5	mA
Input voltage(H+, H-, TH, MIN, CS)	V _{IN}	7	V
Junction temperature	T _{jmax}	150	°C

* Reduce by 7.0mW/°C over T_a=25°C.

(On 70.0mm × 70.0mm × 1.6mm glass epoxy board)

* * This value is not to exceed P_d.

OPERATING CONDITIONS

Parameter	Symbol	Limit	Unit
Operating supply voltage range	V _{cc}	3.5 to 17.0	V
Hall input voltage range	V _H	0 to V _{cc} -2.0	V
		0 to 7.0	V
TH input voltage range	V _{TH}	0 to V _{REF}	V
MIN input voltage range	V _{MIN}	0 to V _{REF}	V

less than V_{cc}=9.0V
more than V_{cc}=9.0V

* This product is not designed for production against radioactive rays.

* This document may be strategic data subject to COCOM regulations.

OELECTRICAL CHARACTERISTICS (Unless otherwise specified Ta=25°C, Vcc=12V)

Parameter	Symbol	Limit			Unit	Conditions
		Min.	Typ.	Max.		
Circuit current	Icc	3	5	8	mA	
Hall input hysteresis +	VHYS+	4	9	16	mV	
Hall input hysteresis -	VHYS-	-18	-13	-8	mV	
Output voltage	VO	-	0.6	0.9	V	Io=200mA, Upper and Lower total
Lock detection ON time	TON	0.3	0.5	0.7	s	
Lock detection OFF time	TOFF	3.0	5.0	7.0	s	
FG output low voltage	VFGL	-	0.15	0.3	V	IFG =2mA
FG output leak current	IFGL	-	-	10	μA	VFG=17V
OSC low voltage	VOSCL	0.8	1.0	1.2	V	
OSC high voltage	VOSCH	2.3	2.5	2.7	V	
OSC charge current	ICOSC	-16	-8	-4	μA	
OSC discharge current	IDOSC	4	8	16	μA	
Output ON Duty 1	DUTY1	75	80	85	%	VTH=VREF × 0.222 OUT1-OUT2=1kΩ, COSC=100pF
Output ON Duty 2	DUTY2	45	50	55	%	VTH=VREF × 0.294 OUT1-OUT2=1kΩ, COSC=100pF
Output ON Duty 3	DUTY3	15	20	25	%	VTH=VREF × 0.367 OUT1-OUT2=1kΩ, COSC=100pF
REF voltage	VREF	5.8	6.0	6.2	V	IREF =-2mA
Hall bias voltage	VHB	1.10	1.3	1.5	V	IHB =-2mA
Current limit voltage	VCL	280	310	340	mV	
TH bias current	ITH	-	-	0.2	μA	
MIN bias current	IMIN	-	-	0.2	μA	
CS bias current	ICS	-	-	0.2	μA	

The drawing shows three views of the D6971 component:

- Top View:** A square component with a width of 5.0 ± 0.2 and a height of 6.4 ± 0.3 . It features 14 pins: 8 on the top edge, 1 on the left edge, 7 on the bottom edge, and 8 on the right edge. The pin pitch is 0.65 . The component is labeled "D6971" and "Lot No." with a pointer to a rectangular area on the bottom edge.
- Side View:** Shows the component's profile with a maximum height of 0.3 Min. and a base thickness of 0.15 ± 0.1 .
- Detail View:** A close-up of the bottom edge showing a semi-circular feature with a radius of 0.1 and a width of 0.22 ± 0.1 . The distance from the left edge to this feature is 0.15 ± 0.1 , and the distance from the feature to the right edge is 0.1 .

SSOP-B14 (UNIT: mm)

The block diagram illustrates the internal architecture of the TDA5050 motor driver IC. Key components include:

- Input/Output Pins:** FG (1), H- (2), HB (3), H+ (4), CS (5), OUT2 (6), RNF (7), GND (14), OSC (13), MIN (12), TH (11), REF (10), Vcc (9), OUT1 (8).
- Functional Blocks:** SIGNAL OUTPUT, QUICK START, TSD, SOFT SWITCH, LOCK PROTECTION, OSC, HB, HALL COMP, MINPWM COMP, THPWM COMP, CURRENT LIMIT COMP, CONTROL LOGIC, PRE DRIVER, REF.
- Connections:**
 - Pin 1 (FG) connects to SIGNAL OUTPUT.
 - Pin 2 (H-) connects to the HALL COMP and MINPWM COMP.
 - Pin 3 (HB) connects to the HB block.
 - Pin 4 (H+) connects to the HALL COMP.
 - Pin 5 (CS) connects to the CURRENT LIMIT COMP.
 - Pin 6 (OUT2) connects to the PRE DRIVER.
 - Pin 7 (RNF) connects to the PRE DRIVER.
 - Pin 14 (GND) is the ground reference.
 - Pin 13 (OSC) connects to the OSC block.
 - Pin 12 (MIN) connects to the MINPWM COMP.
 - Pin 11 (TH) connects to the THPWM COMP.
 - Pin 10 (REF) connects to the REF block.
 - Pin 9 (Vcc) is the power supply input.
 - Pin 8 (OUT1) connects to the PRE DRIVER.

PIN No.	Terminal name
1	FG
2	H-
3	HB
4	H+
5	CS
6	OUT2
7	RNF
8	OUT1
9	V _{cc}
10	REF
11	TH
12	MIN
13	OSC
14	GND

CAUTIONS ON USE

1) Absolute maximum ratings

An excess in the absolute maximum ratings, such as supply voltage, temperature range of operating conditions, etc., can break down the devices, thus making impossible to identify breaking mode, such as a short circuit or an open circuit. If any over rated values will expect to exceed the absolute maximum ratings, consider adding circuit protection devices, such as fuses.

2) Connecting the power supply connector backward

Connecting of the power supply in reverse polarity can damage IC. Take precautions when connecting the power supply lines. An external direction diode can be added.

3) Power supply line

Back electromotive force causes regenerated current to power supply line, therefore take a measure such as placing a capacitor between power supply and GND for routing regenerated current. And fully ensure that the capacitor characteristics have no problem before determine a capacitor value. (when applying electrolytic capacitors, capacitance characteristic values are reduced at low temperatures)

4) GND potential

It is possible that the motor output terminal may deflect below GND terminal because of influence by back electromotive force of motor. The potential of GND terminal must be minimum potential in all operating conditions, except that the levels of the motor outputs terminals are under GND level by the back electromotive force of the motor coil. Also ensure that all terminals except GND and motor output terminals do not fall below GND voltage including transient characteristics. Malfunction may possibly occur depending on use condition, environment, and property of individual motor. Please make fully confirmation that no problem is found on operation of IC.

5) Thermal design

Use a thermal design that allows for a sufficient margin in light of the power dissipation (Pd) in actual operating conditions.

6) Inter-pin shorts and mounting errors

Use caution when positioning the IC for mounting on printed circuit boards. The IC may be damaged if there is any connection error or if pins are shorted together.

7) Actions in strong electromagnetic field

Use caution when using the IC in the presence of a strong electromagnetic field as doing so may cause the IC to malfunction.

8) ASO

When using the IC, set the output transistor so that it does not exceed absolute maximum ratings or ASO.

9) Thermal shut down circuit

The IC incorporates a built-in thermal shutdown circuit (TSD circuit). Operation temperature is 175°C (typ.) and has a hysteresis width of 25°C (typ.). When IC chip temperature rises and TSD circuit works, the output terminal becomes an open state. TSD circuit is designed only to shut the IC off to prevent thermal runaway. It is not designed to protect the IC or guarantee its operation. Do not continue to use the IC after operation this circuit or use the IC in an environment where the operation of this circuit is assumed.

10) Testing on application boards

When testing the IC on an application board, connecting a capacitor to a pin with low impedance subjects the IC to stress. Always discharge capacitors after each process or step. Always turn the IC's power supply off before connecting it to or removing it from a jig or fixture during the inspection process. Ground the IC during assembly steps as an antistatic measure. Use similar precaution when transporting or storing the IC.

11) GND wiring pattern

When using both small signal and large current GND patterns, it is recommended to isolate the two ground patterns, placing a single ground point at the ground potential of application so that the pattern wiring resistance and voltage variations caused by large currents do not cause variations in the small signal ground voltage. Be careful not to change the GND wiring pattern of any external components, either.

12) Capacitor between output and GND

When a large capacitor is connected between output and GND, if Vcc is shorted with 0V or GND for some cause, it is possible that the current charged in the capacitor may flow into the output resulting in destruction. Keep the capacitor between output and GND below 100uF.

13) IC terminal input

When Vcc voltage is not applied to IC, do not apply voltage to each input terminal. When voltage above Vcc or below GND is applied to the input terminal, parasitic element is actuated due to the structure of IC. Operation of parasitic element causes mutual interference between circuits, resulting in malfunction as well as destruction in the last. Do not use in a manner where parasitic element is actuated.

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